Math Myths

Busted? Confirmed? More evidence needed?

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Myths

- Commonly held beliefs
- At CAMPPP, we've been working to "bust" or "confirm" beliefs that we hear may be inhibiting or enabling strategic mathematics improvement actions in various parts of the province

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Myth: The closer together the numerator and denominator of a fraction are, the bigger the fraction.

- Counter-example: A: 5/4 and B: 5/3. A's numerator and denominator are closer together than B's, yet 5/4 is not bigger.
- When I was thinking about this myth I was only thinking about comparing fractions with the same denominator...the problem is that if we allow students to compare in that way they may transfer this generalization to fractions with different denominators and run into difficulty

Myth: The closer together the numerator and denominator of a fraction are, the bigger the fraction.

Another way to say this …

- The closer together the numerator and denominator of a fraction are, the closer the fraction approaches one -
  from below one for proper fractions

  1/6 2/6 3/6 4/6 5/6 → 6/6

  or from above one for improper fractions
  10/6 9/6 8/6 7/6 → 6/6

Clarifying - Fractions *Can* be Greater Than 1.

- Curriculum Policy:

  "count forward by halves, thirds, fourths, and tenths to beyond one whole, using concrete materials and number lines (e.g., use fraction circles to count fourths: "One fourth, two fourths, three fourths, four fourths, five fourths, six fourths, …")"

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Clarifying - Fractions *Can* be Greater Than 1

- Curriculum Policy:

  describe multiplicative relationships between quantities by using simple fractions and decimals e.g., “If you have 4 plums and I have 6 plums, I can say that I have 1 ½ or 1.5 times as many plums as you have.”

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Clarifying *Simple* Fractions

- $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \ldots, \frac{1}{1093}, \ldots$ Unit Fractions
- $\frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{4}{5}, \ldots, \frac{97}{2301}$

Proper Fractions

- $\frac{3}{2}, \frac{4}{3}, \frac{6}{3}, \frac{7}{2}, \ldots, \frac{87}{86}$, …Improper Fractions
- $1\frac{1}{2}, 2\frac{3}{7}, 9\frac{2}{5}, \ldots$,…Mixed Numbers

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Myth: The best way to accommodate students with learning disabilities is to break a task down into very small steps.

- CAMPPPer:
  "Very small steps remove the thinking from the question. The teacher does the thinking to create the steps and the student executes the steps. Students with memory issues (or not) won't remember the steps next time - there is no connection to other areas of math for them to fall back on either – just a recipe to follow."

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Myth: The best way to accommodate students with learning disabilities is to break a task down into very small steps.

- An Adobe Connect participant, said, “I think suggesting that there is one 'best way' to meet the learning needs of all students with a learning disability does not honour that all LD students have a very individual learning profile. Sometimes I think breaking down a task can reduce student ownership for thinking, so I'm always cautious in using this approach.”

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Another way to say this …

- The best way to accommodate students with learning disabilities is to know what their strengths and challenges are, and accommodate accordingly.

Clarifications

- “Chunking” is a strategy used to improve memory performance by organizing disparate pieces of information into meaningful chunks.

- “Scaffolding” is an instructional strategy used to facilitate student’s learning by building on their prior knowledge. Scaffolding often involves posing strategic questions and providing descriptive feedback.

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Clarifications

- Neither chunking nor scaffolding means breaking tasks down into very small steps.

Myth: Focusing on instructional strategies during professional learning will naturally provide opportunities for deepening specialized content knowledge for teaching mathematics.

- "Instructional strategies are a 'delivery system' that *could* help deepen understanding of math, but not necessarily. For example, someone could use a think-Pair-Share, but the group doesn't stretch/deepen their knowledge of math."

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Myth: Focusing on instructional strategies during professional learning will naturally provide opportunities for deepening specialized content knowledge for teaching mathematics.

- An Adobe Connect participant said: I think there would need to be an intentional focus on how specific instructional strategies could support student understanding of a concept in order to develop specialized content knowledge. I guess I'm saying the instructional strategies focus wouldn't be sufficient.

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Another way to say this …

- To deepen specialized content knowledge for teaching mathematics, it is more effective to focus professional learning on a targeted content area in conjunction with high-yield strategies.

Myth: Open questions cannot be marked objectively.

- Generally agreed upon. For example,
  - "Teachers will have already anticipated some student responses (basis for assessment)
  - Marking will be based in part on how well a student has justified thinking
  - There will still be an element of mathematical correctness to consider
  - If an answer is unclear, the teacher can probe for understanding

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Myth: Fractions are always parts of a whole.

- Many traditional North American resources explicitly ask us to think about fractions as part to whole relationships. E.g.,

  "represent fractions using concrete materials, words, and standard fractional notation, and explain the meaning of the denominator as the number of the fractional parts of a whole or a set, and the numerator as the number of fractional parts being considered"

More Work Needed - Fractions are always parts of a whole.

- Our current research is suggesting that a broader understanding (beyond part-whole) is involved in teaching and learning fractions
- Our students bring all of these to the table when we teach fractions, and we, ourselves flip amongst the various meanings, often unconsciously

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We Can Say

- Fractions are more than just part-whole relationships.
- Context determines how you understand fractional relationships.
- Research has uncovered at least five ways of thinking about fractional relationships. See *Math for Teaching: Fraction Meanings* for detail.

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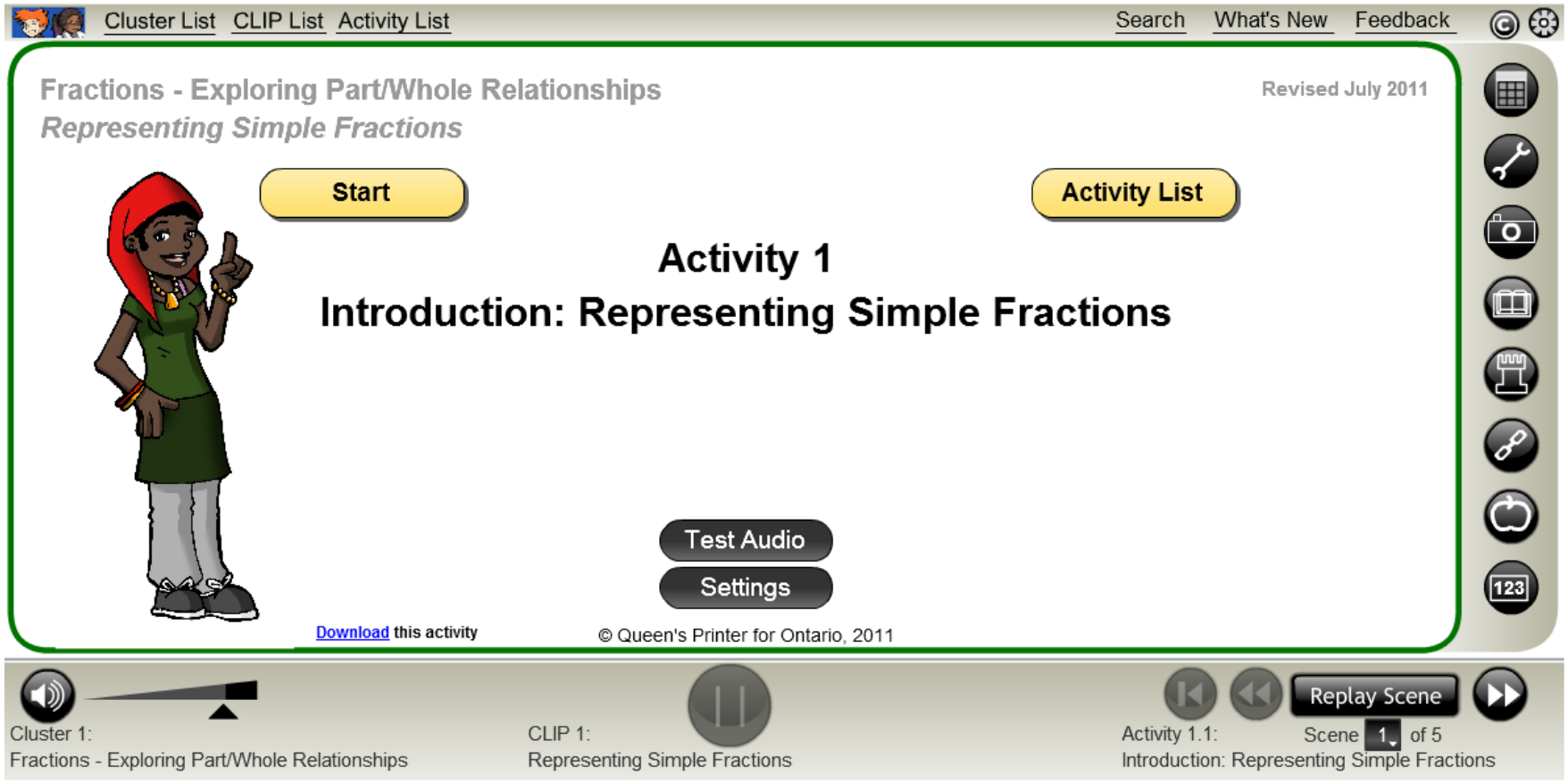
Cluster List
CLIP List
Activity List
Search
What's New
Feedback
Fractions - Exploring Part/Whole Relationships
Representing Simple Fractions
Revised July 2011
Start
Activity List
Activity 1
Introduction: Representing Simple Fractions
Test Audio
Settings
Download this activity
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Cluster 1:
Fractions - Exploring Part/Whole Relationships
CLIP 1:
Representing Simple Fractions
Replay Scene
Activity 1.1:
Scene 1 of 5
Introduction: Representing Simple Fractions

Myth: A mathematics topic e.g., Fractions can be taught effectively over a period of time rather than in a concentrated timeframe.

- “Like anything, if you teach it in isolation, it may only be used in isolation.”
- “Fractions can be applied in all other strands.”

Myth: A mathematics topic e.g., Fractions can be taught effectively over a period of time rather than in a concentrated timeframe.

- "The division of the math curriculum into strands is artificial – there is a lot of overlap. Students need a point of focus to develop understanding and know that they are learning. A better focus than, say, fractions, would be a big idea such as "Numbers tell us how much or how many.""

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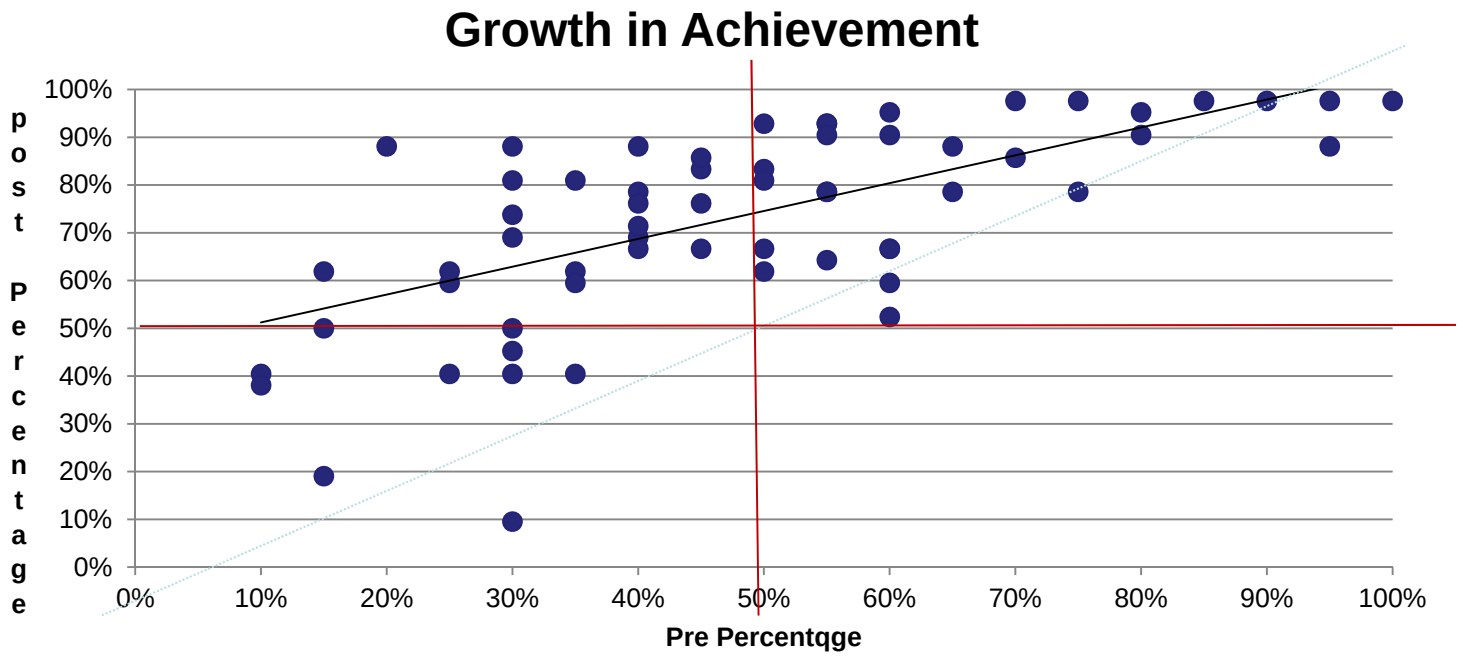
Myth: A mathematics topic e.g., Fractions can be taught effectively over a period of time rather than in a concentrated timeframe.



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Myth: Using a blend of observation, conversation, and product is a viable way to collect Assessment *of* Learning data.

- General agreement
- See the Mathematics Curriculum document
- See *Growing Success*

Myth: All lessons should be 3-part lessons

- Two perspectives:
  - "I put CONFIRM because I think that any worthwhile lesson offers students an opportunity to activate prior knowledge, discuss with their peers and then consolidate their learning."
  - "I would say BUST this myth, as there are times when extra practice and consolidation is the goal of a lesson."

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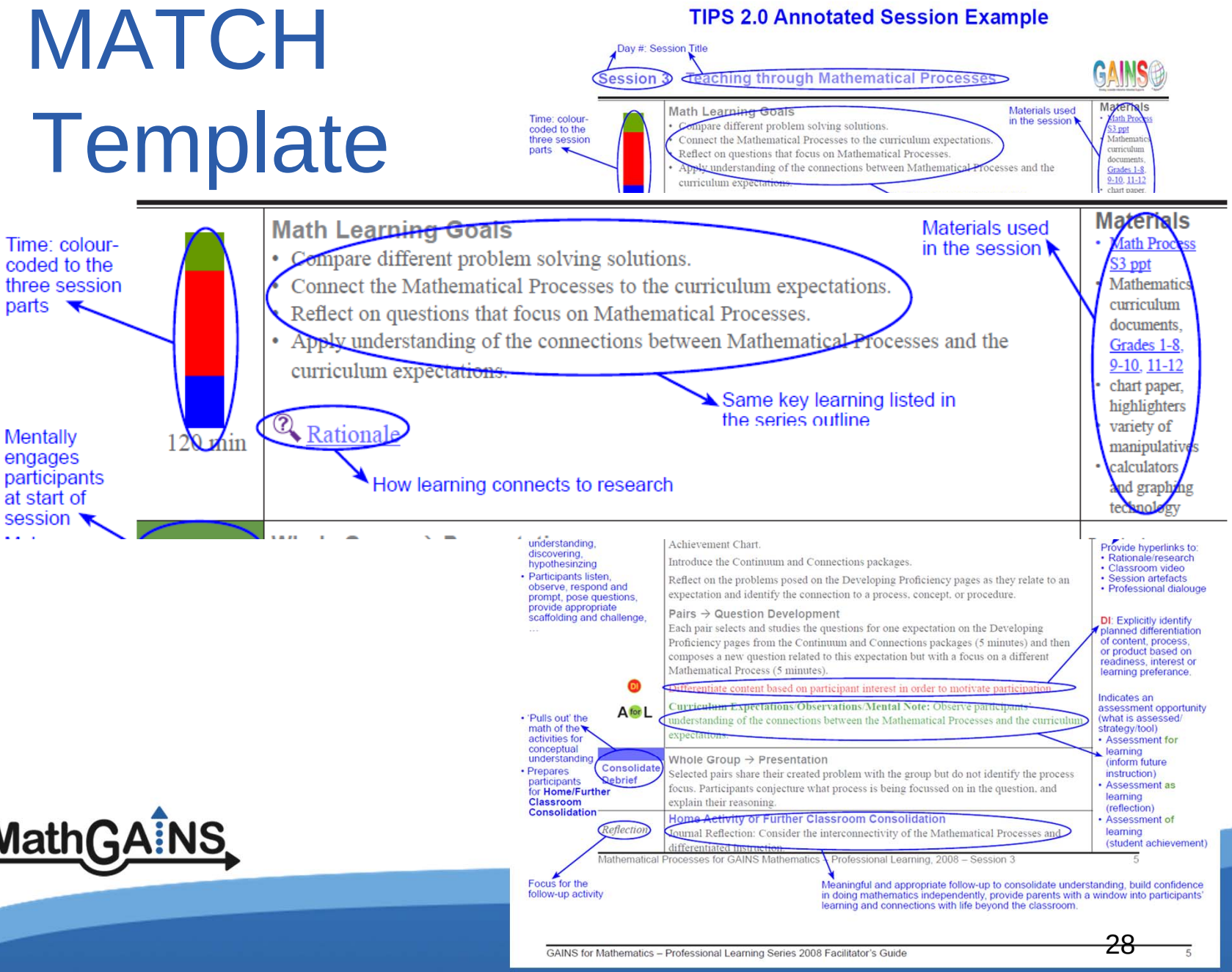
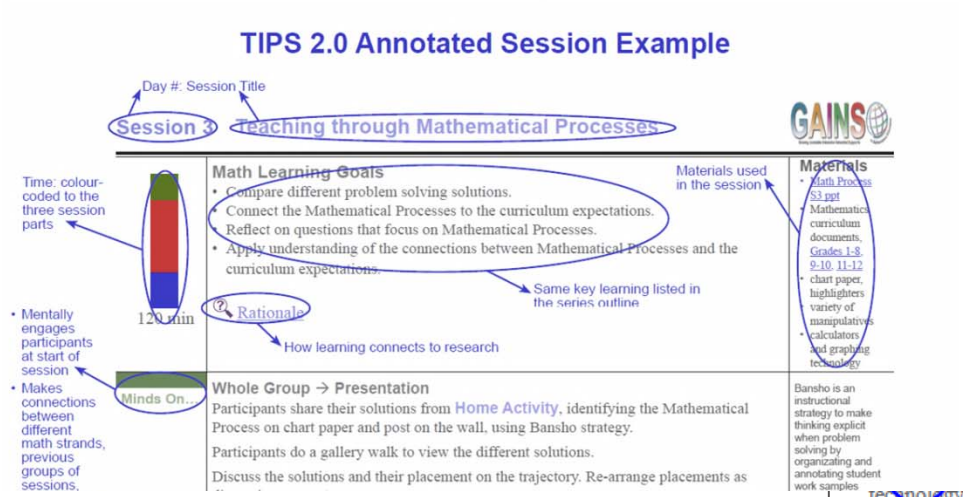
Myth: All lessons should be 3-part lessons

- The 3-part lesson structure does NOT call for all lessons to have the same type of learning goal. In fact, we think there are at least five types of lessons…

MATCH Template



MATCH Template



session

- Makes connections between different math strands, previous groups of sessions, prior learning interests
- Introduces a problem or motivating activity

Minds On...

Whole Group → Presentation

Participants share their solutions from **Home Activity**, identifying the Mathematical Process on chart paper and post on the wall, using Bansho strategy.

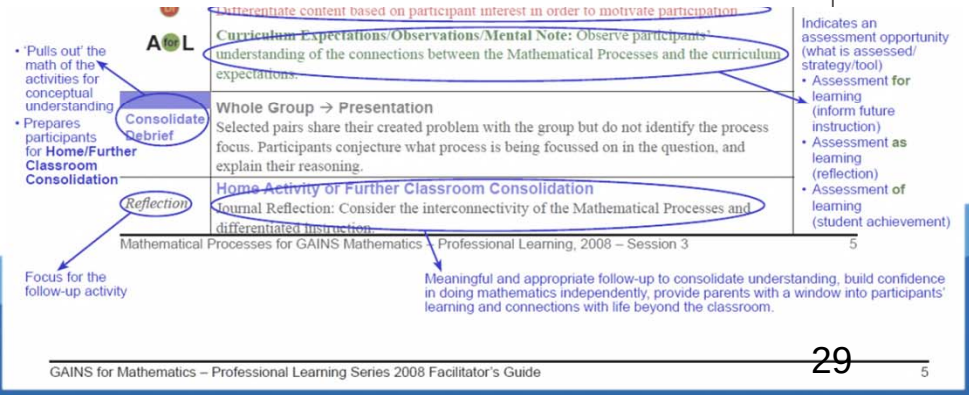
Participants do a gallery walk to view the different solutions.

Discuss the solutions and their placement on the trajectory. Re-arrange placements as discussion warrants.

Whole Group → Discussion

Lead a discussion on how solving problems in several ways promotes the use of the Mathematical Processes (Session 2 journal entry). Participants add to or modify their journal entries.

Bansho is an instructional strategy to make thinking explicit when problem solving by organizating and annotating student work samples through classroom discourse.
Note: a minimum of 5 solutions is needed to Bansho.



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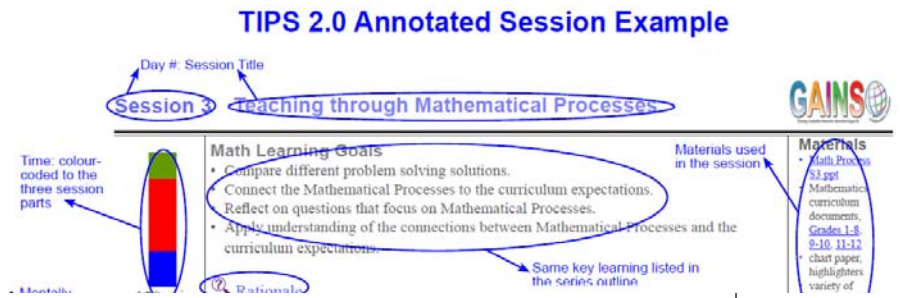
MATCH Template



Action!

Do mathematics: reflecting, discussing, observing, investigating, exploring, creating listening, reasoning, making connections, demonstrating understanding, discovering, hypothesinzing

Participants listen, observe, respond and prompt, pose questions, provide appropriate scaffolding and challenge, …

Small Group → Investigation

In groups of 2 or 3, participants select an overall expectation for a strand of a course or grade using the curriculum documents.

Participants investigate how Mathematical Processes are included in the curriculum expectation.

Suggest a grouping → teaching/learning strategy

Whole Group → Study

Identify the connections between the Mathematical Processes and the categories of the Achievement Chart.

Introduce the Continuum and Connections packages.

Reflect on the problems posed on the Developing Proficiency pages as they relate to an expectation and identify the connection to a process, concept, or procedure.

Pairs → Question Development

Each pair selects and studies the questions for one expectation on the Developing Proficiency pages from the Continuum and Connections packages (5 minutes) and then composes a new question related to this expectation but with a focus on a different Mathematical Process (5 minutes).

Differentiate content based on participant interest in order to motivate participation

Curriculum Expectations/Observations/Mental Note: Observe participants' understanding of the connections between the Mathematical Processes and the curriculum expectations.

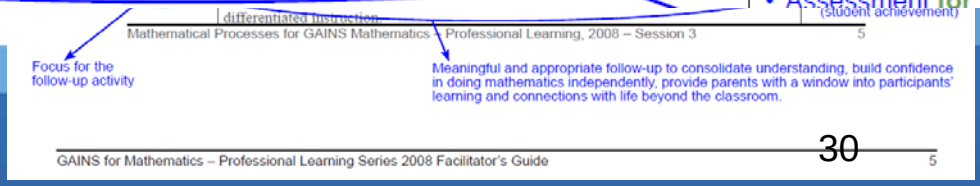
Developing Proficiency pages from TIPS Continuum and Connections packages for perimeter, area and volume; patterning; and equations.

Provide hyperlinks to:
- Rationale/research
- Classroom video
- Session artefacts
- Professional dialouge

DI: Explicitly identify planned differentiation of content, process, or product based on readiness, interest or learning preferance.

Indicates an assessment opportunity (what is assessed/ strategy/tool)
- Assessment for

'Pulls out' the math of the activities for



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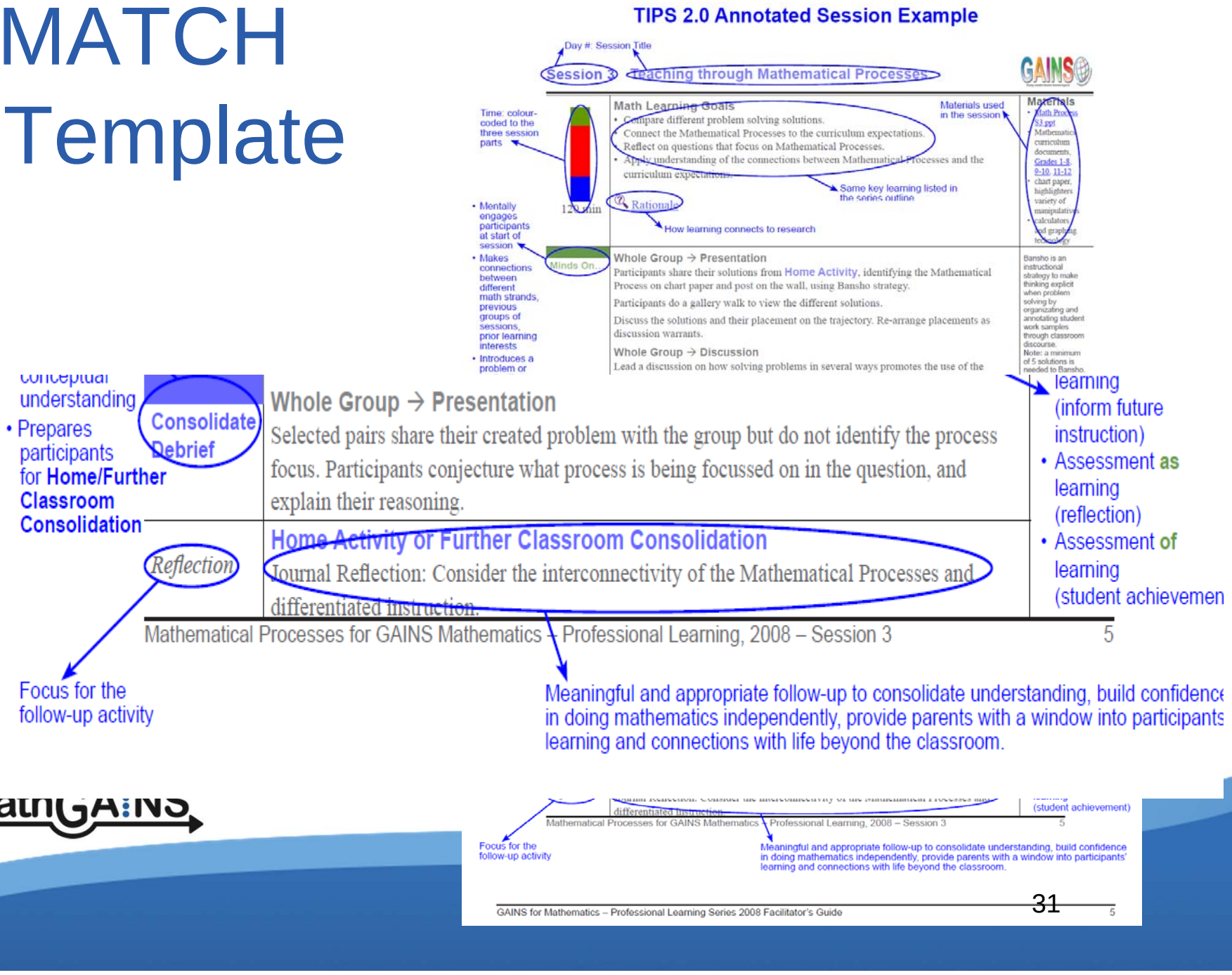
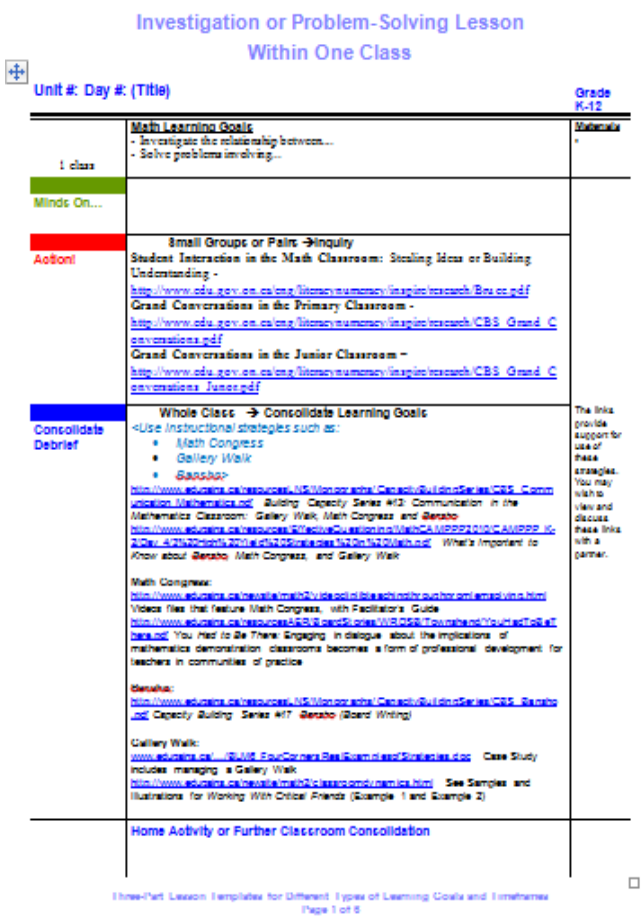


Three-Part Lesson Designs

5 Designs
1 overview

What's the Same?

What's Different?

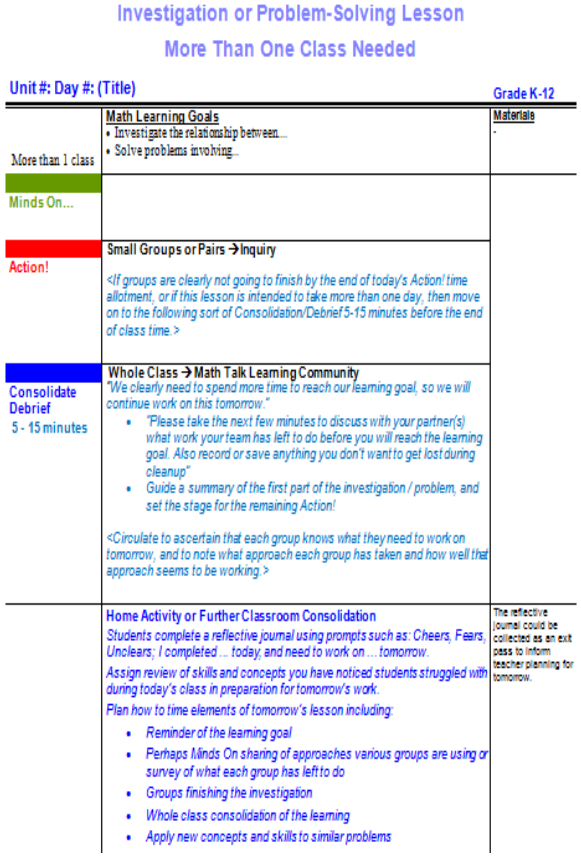


Investigation or Problem-Solving Lesson
Within One Class

Unit #: Day #: (Title) — Grade K-12

	Math Learning Goals - Investigate the relationship between... - Solve problems involving...	Materials -
1 class		
Minds On...		
Action!	Small Groups or Pairs → Inquiry **Student Interaction in the Math Classroom: Stealing Ideas or Building Understanding -** http://www.edu.gov.on.ca/eng/literacynumeracy/inspire/research/Bruce.pdf **Grand Conversations in the Primary Classroom -** http://www.edu.gov.on.ca/eng/literacynumeracy/inspire/research/CBS_Grand_Conversations.pdf **Grand Conversations in the Junior Classroom –** http://www.edu.gov.on.ca/eng/literacynumeracy/inspire/research/CBS_Grand_Conversations_Junior.pdf	
Consolidate Debrief	Whole Class → Consolidate Learning Goals <Use instructional strategies such as: • *Math Congress* • *Gallery Walk* • *Sensho*> http://www.edugains.ca/resources/LNS/Monograph/CapacityBuildingSeries/CBS_Communication_Mathematics.pdf *Building Capacity Series #13: Communication in the Mathematics Classroom: Gallery Walk, Math Congress and Sensho* http://www.edugains.ca/resources/SIPrincipalQuestion/InWebCAMPPP2NDCAMPPP_K-2Day_4-7%20Short%20Version.pps?Dir%3D%2Fweb *What's Important to Know about Sensho, Math Congress, and Gallery Walk* Math Congress: http://www.edugains.ca/newsite/math2/videoclipsphotobyauthor.html#analyzing.html Videos files that feature Math Congress, with Facilitator's Guide http://www.edugains.ca/resources/LNS/FrenchSchools/WELCOMEToYourHandYouHadToBeThere.pdf *You Had to Be There: Engaging in dialogue about the implications of mathematics demonstration classrooms becomes a form of professional development for teachers in communities of practice* Sensho: http://www.edugains.ca/resources/LNS/Monograph/CapacityBuildingSeries/CBS_Sensho.pdf *Capacity Building Series #17: Sensho (Board Writing)* Gallery Walk: www.edugains.ca/.../SI-WE-FourCorners-RealRoomIssue/Standards.doc Case Study includes managing a Gallery Walk http://www.edugains.ca/newsite/math2/classroomdynamics.html See Samples and Illustrations for *Working With Critical Friends* (Example 1 and Example 2)	The links provide support for use of these strategies. You may wish to view and discuss these links with a partner.
	Home Activity or Further Classroom Consolidation	

Three-Part Lesson Templates for Different Types of Learning Goals and Timeframes
Page 1 of 6



Investigation or Problem-Solving Lesson
More Than One Class Needed

Unit #: Day #: (Title) — Grade K-12

	Math Learning Goals • Investigate the relationship between... • Solve problems involving...	Materials -
More than 1 class		
Minds On...		
Action!	Small Groups or Pairs → Inquiry <*If groups are clearly not going to finish by the end of today's Action! time allotment, or if this lesson is intended to take more than one day, then move on to the following sort of Consolidation/Debrief 5-15 minutes before the end of class time.*>	
Consolidate Debrief 5 - 15 minutes	Whole Class → Math Talk Learning Community *"We clearly need to spend more time to reach our learning goal, so we will continue work on this tomorrow."* • *"Please take the next few minutes to discuss with your partner(s) what work your team has left to do before you will reach the learning goal. Also record or save anything you don't want to get lost during cleanup"* • *Guide a summary of the first part of the investigation / problem, and set the stage for the remaining Action!* <*Circulate to ascertain that each group knows what they need to work on tomorrow, and to note what approach each group has taken and how well that approach seems to be working.*>	
	Home Activity or Further Classroom Consolidation *Students complete a reflective journal using prompts such as: Cheers, Fears, Unclears; I completed ... today, and need to work on ... tomorrow.* *Assign review of skills and concepts you have noticed students struggled with during today's class in preparation for tomorrow's work.* *Plan how to time elements of tomorrow's lesson including:* • *Reminder of the learning goal* • *Perhaps Minds On sharing of approaches various groups are using or survey of what each group has left to do* • *Groups finishing the investigation* • *Whole class consolidation of the learning* • *Apply new concepts and skills to similar problems*	The reflective journal could be collected as an exit pass to inform teacher planning for tomorrow.

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How Do Accommodations Connect?

- What sorts of accommodations would you plan for each part of one of the lesson types?

How Does Questioning Connect?

- Where in these 5 Lesson Design Templates would teachers pose questions that invite:
  a. evaluative listening?
  b. interpretive listening?

Acting Strategically

Examining Our Current Reality

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Why Is Current Reality Important?

- Prevents spending energy/resources on non-existent problems
- Helps target activities more precisely
- Provides motivation for continuing what's making a positive difference
- Provides impetus for shifting practices that aren't helping quickly or significantly
- Helps justify our work based on what we know is true rather than just what we think may be true

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Evidence of Current Reality

- Not just an opinion
- Facts and data
- Observable – things you see, conversations you have, products you collect
- Based on deep understanding of whatever is being monitored
- Connected to an important goal

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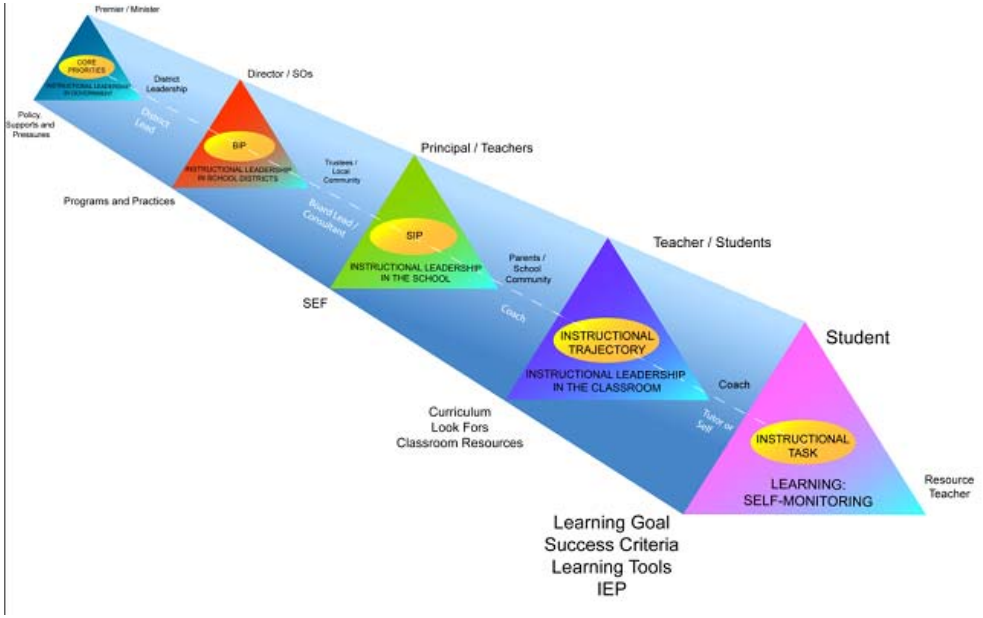
What Are Examples of Important Goals?

- It Depends …
  … where you are working with respect to the Instructional Core



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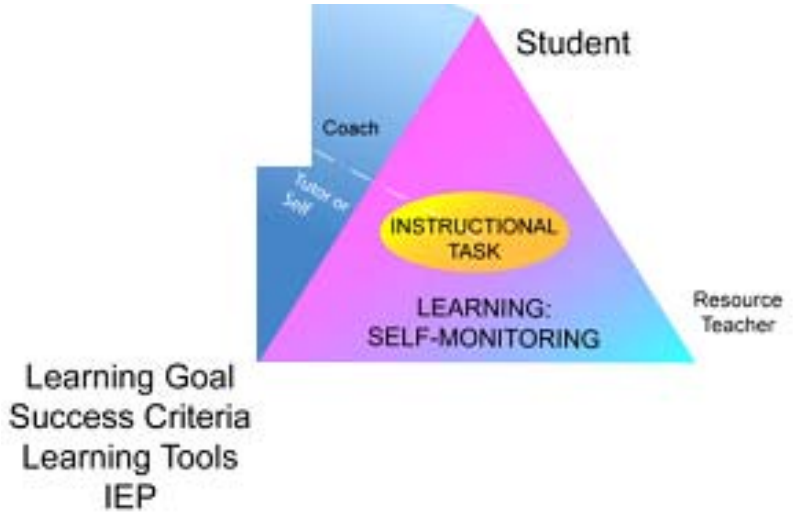
Important at the Learner Level

- Do I understand what I'm being taught?
- Am I engaged in learning this?
- Am I confident?
- Will I have a chance to show my teacher that I know this or get individual feedback on this?



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Student Learning Measures

- Observations
  - Academic engagement, accommodations
  - Attendance
  - Engagement; classroom dynamics
- Conversations
  - Class and student profiles
- Products
  - EQAO reports
  - Report cards

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Monitoring Engagement

- “If students aren’t engaged, they’re not learning, plain and simple, so knowing whether or not students are engaged, of course, is mighty important.” Jim Knight

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Engagement Form – Jim Knight

DATE:

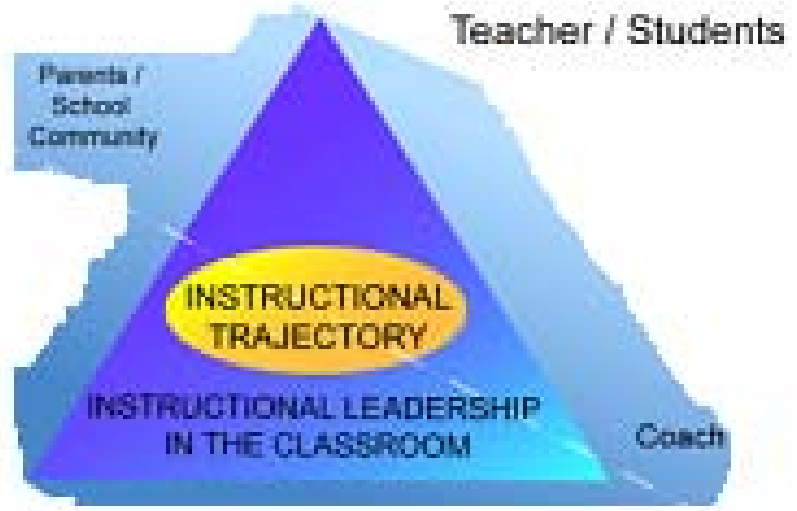
INSTRUCTIONS:

Each time you hear the bell, please rate how engaging the learning activity is in which you are involved. You are only to rate whether or not the learning activity is engaging for you.

I'M BORED			NEUTRAL			I'M VERY ENGAGED
1	2	3	4	5	6	7
1	2	3	4	5	6	7
1	2	3	4	5	6	7

Important at the Classroom Level

- How are the instructional shifts I am trying impacting my students' learning?



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Measures of Teacher Practice

- Observations
  - Classroom visits Types of questions posed
- Conversations
  - interviews with students
  - listening to teacher co-planning
- Products
  - Lesson plans
  - Evidence/data about teacher efficacy, and student engagement and achievement

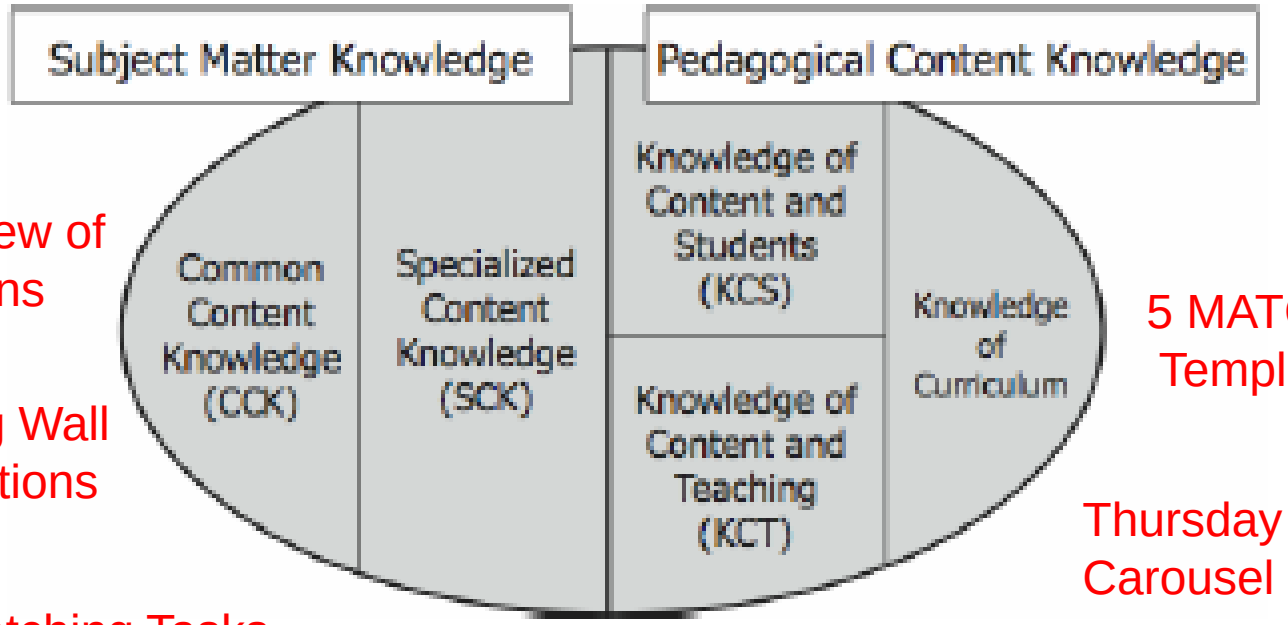
MathGAINS http://people.ehe.osu.edu/ahoy/research/instruments

Posing Questions to Evoke and Expose Thinking

- What type of listening do the teacher's questions support
  - ❑ Evaluative listening?
  - ❑ Interpretive listening?

At CAMPPP

Accommodations



K-12 View of Fractions

Learning Wall for Fractions

Triad Matching Tasks

5 MATCH Templates

Thursday Carousel

Why Students Struggle with Fractions

Assessment Portfolio

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Your Actions

Now

- What action will you take?
- What do you expect?

Later

- What really happened?
- What will you change?

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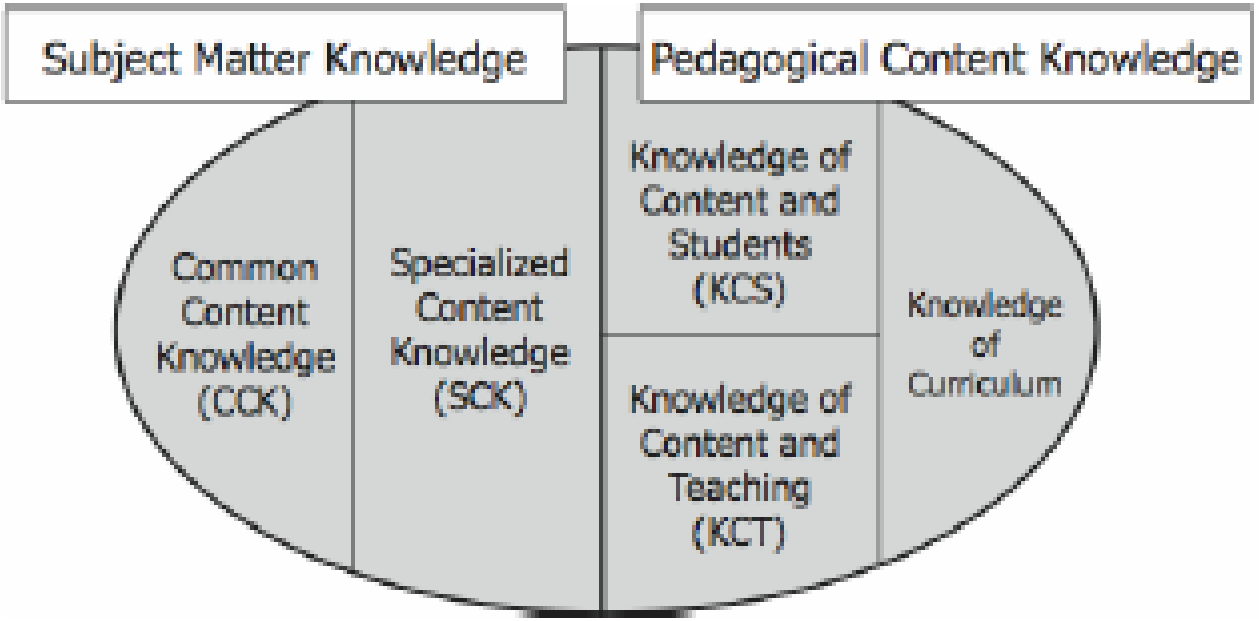
Your 2012-13 School Year



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Important at the Board Level

- Are we making progress towards our BIPSA? For example:
  - How are we closing gaps?
  - What are our areas of strengths and needs as evidenced by our school visits?

  - Are our professional learning / coaching activities helping teachers continue to shift their practices to improve student achievement?

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Important at the School Level

- Are we making progress towards our SIPSA? For example:
  - How are our struggling students improving?
  - What are our areas of strengths and needs as evidenced by our classroom visits?
  - Are our professional learning / coaching activities helping teachers shift their practices?

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Important at the Ministry Level

Are we closing gaps?

Evidence:

- Graduation rates
- Achievement by student groupings

Actions:

- Targeting of boards for supports of Schools in the Middle, CIL-M projects, Intermediate Years Projects, etc.
- Development of *Gap Closing* resources

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Important at the Ministry Level

Are we increasing student achievement?

Evidence:

- Annual EQAO results Grades 3, 6, 9
- National and international assessments

Actions:

- Hosting provincial professional learning activities e.g., Math CAMPPP
- Funding multi-year School College Math Project

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Important at the Ministry Level

Are we increasing public confidence?

Evidence:

- Media
- Letters to the ministry

Actions:

Creation of www.mathies.ca

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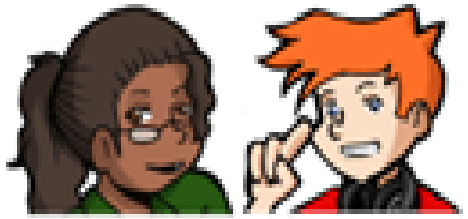
DRAFT

Interactive

Mathematics



Electronic

Supports

mathies

DRAFT

www.mathies.ca

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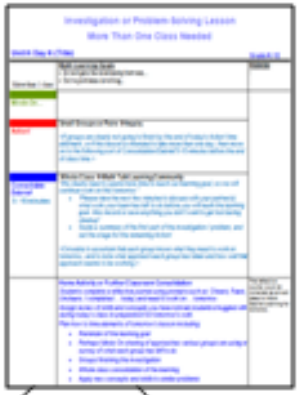
What will my child's mathematics classes be like?

Investigation or Problem Solving Lesson Within One Class

Investigation or Problem Solving Lesson- More Than One Class Needed



Teacher-Guided Lesson

Lesson Focused on Practice e.g., Game, Stations

Lesson Focussed on Review e.g., summative instruction, differentiated practice

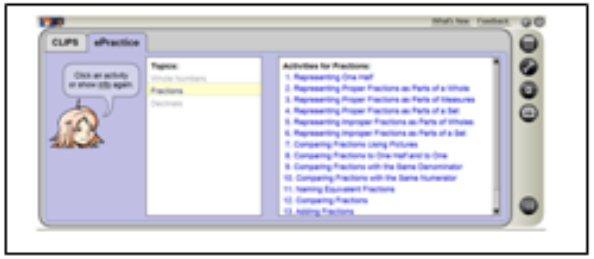
Balanced and Effectively Structured Mathematics Lessons

How can I help my child learn mathematics?

Co-learn with your child at a computer using these fun, interactive, web-based resources. Or, let your child do one of the *Show What You Know* activities with you after they learn themselves. Meaningful feedback is built in for all interactions.

The Learner
Innovative problem solver, reflective and adaptive reasoner, effective meaning and connection maker, mathematical communicator, and collaborative co-learner

Use the Facilitator's Guide suggestions to support your child's work on tasks in the Learner's Think Book. Examples of all answers are provided. Available for Grades K-1, 2-3, 4-5, 6-7, 7-8. Facilitator's Guides written for non-educators.



Co-learn with your child at a computer using fun, sharply focused, interactive, web-based resources that align with Gap Closing materials. Currently useful for students in Grades 4 and up.

Sign up for the RSS feed on the Homepages of MathGAINS and LNS Resources

Keep Connected

www.edugains.ca

and

www.mathies.ca

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